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Mr. Timothy A. Frazier
Designated Federal Officer
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, D.C. 20585

Subject: Comments on Reactor and Fuel Cycle Technology Subcommittee Report to the Full Commission, Draft Report, June 2011

Dear Mr. Frazier:

GE Hitachi Nuclear Energy ("GEH") appreciates the opportunity to submit comments to the Subcommittee and wholeheartedly agrees that there is a need for a strong U.S. RD&D program to develop the next generation fuel cycle technology. We strongly believe that the technology being deployed in other nations is not the right technological approach for the U.S. and that the U.S. has the capability to develop an American recycling technology in fewer than two decades.

The U.S. nuclear industry needs to retain its decades-long leadership and to counter the challenges from countries that take an active role in their nation's nuclear industry. Developing the next generation of recycling technology is one critical area where the U.S. can lead. Recent reports of investments into advanced reactors by other countries provide a wakeup call. These countries will leave the U.S. behind if we do not develop a clear strategy forward. We have reached a critical point in our domestic nuclear program's advancement, and we are poised as an industry to develop the next generation of advanced reactor technologies.

Acknowledging the need for the next generation of advanced reactor technologies, the potential for a U.S. nuclear industry to collaborate and innovate is unsurpassed. The BRC should embrace a framework for innovation that recognizes the possibility of a public/private partnership and promotes the U.S. nuclear industry coming together to retain and reinforce our leadership in nuclear technology. Through its recommendations, the Subcommittee can help ensure U.S. technological leadership

and at the same time address the difficult policy challenge of nuclear fuel management in a pragmatic way.

Despite our support for many of the Subcommittee's recommendations and our belief in a BRC framework to encourage innovation, we are troubled by a couple of the report's other findings: (1) that the Subcommittee is not confident that recycling using fast reactors would have a sufficient positive effect on addressing used nuclear fuel, and (2) that no currently available or reasonably foreseeable reactor has the potential to fundamentally alter the used fuel management challenge. The attached comments will provide the Subcommittee specific information on these points.

Thank you again for the opportunity to provide comment, and best wishes to the Commission as it continues to deliberate on this important issue.

Sincerely,

Caroline Reda

Caroline Reda, President and CEO
GE Hitachi Nuclear Energy

Comments of GE Hitachi Nuclear Energy on
Draft Report

Reactor and Fuel Cycle Technology Subcommittee Report to the Full Commission

GEH supports the efforts of the Subcommittee in preparing and agrees with many of the positions set forth in the draft Reactor and Fuel Cycle Technology Subcommittee Report to the Full Commission (hereinafter "Subcommittee Draft Report"). GEH appreciates the opportunity to provide comments and suggestions on the following specific topics discussed in the Draft Report and requests that the Subcommittee consider these in preparing the final report.

1. **Benefits of Research, Development, and Demonstration ("RD&D") Are Many**

GEH strongly agrees with the Blue Ribbon Commission ("BRC") Subcommittee that "a well-focused R&D program is critical to enabling the U.S. to regain its role as the global leader of nuclear technology innovation." (Subcommittee Draft Report, page 55). GEH, too, concurs with the recent findings of the President's Council of Advisors on Science and Technologies concerning "the need for better coordination of energy policies and programs across the federal government; for a substantial increase in federal support of energy-related research, development, demonstration, and deployment; and for efforts to explore new revenue options to provide this support." (Subcommittee Draft Report, page vii). As a nuclear technology company, we agree that innovation in the form of public/private partnerships promotes U.S. exports, creates U.S. jobs, and simultaneously offers solutions for many of the energy challenges facing our country.

GEH commends the Subcommittee on its endorsement of sustained energy technology innovation. In its endorsement, the Subcommittee Draft Report references an earlier proposal by the American Energy Innovation Council to provide "$16 billion in annual federal support for energy technology innovation" and recommends that "$12 billion be directed to basic R&D and $4 billion to large-scale demonstration projects." (Id.)

In this economic climate we understand the Subcommittee's reluctance to make judgment about the appropriate level of funding. We underscore, however, the importance of advanced reactor technologies to U.S. energy security and the safe and efficient disposal of used fuel. Accordingly, we believe that implementing this policy effectively for fuel cycle technology will require greater focus and specificity within the Department of Energy's nuclear programs. We also believe that funding

could be used more efficiently with greater direct involvement from U.S. industry, which is driven to apply RD&D in practical and economical applications.

2. Commercial Scale Fuel Reactor Deployment is Foreseeable and Attainable

The Subcommittee Draft Report expresses interest in "the importance and value of continuing and stable industry RD&D investment in reactor and fuel cycle technologies." (Subcommittee Draft Report, page vi). The Subcommittee further opines that "[a]dvances in nuclear reactor and fuel cycle technologies may hold promise for achieving substantial benefits in terms of broadly held safety, economic, environmental, and energy security goals." (Subcommittee Draft Report, page 53). In order to "capture these benefits," the Subcommittee advises that "the United States should continue to pursue a program of nuclear energy research, development, and deployment (RD&D) both to improve the safety and performance of existing technologies and to develop new technologies that could offer significant advantages in terms of the multiple evaluation criteria identified in our charter (i.e., safety, cost, resource utilization and sustainability, waste management, and non-proliferation and counter-terrorism)." (Id.).

The Subcommittee further opines that, "[a]lternatives to the once-through fuel cycle or to the modified open fuel cycle will require decades of development before they are ready for widespread commercial application." (Id.). GEH concurs with the Subcommittee that advanced reactor and fuel cycle technologies are important and deserve RD&D support, yet respectfully disagrees with the Subcommittee's assertion that advanced reactors will require decades of development.

In particular, decades of advanced fuel cycle research and development have been performed in the U.S., such as in the Department of Energy's ("DOE") Liquid Metal Reactor Program, Advanced Liquid Metal Reactor program (ALMR), and the Global Nuclear Energy Partnership. As one example, GEH presented to the BRC recycling technology that would commercialize the U.S. RD&D efforts accomplished during the ALMR. DOE funding contributed much to this technology's development; private companies can be incented to further develop and deploy it in the near-term. Accordingly, it is unclear to GEH how the Subcommittee could reach its conclusion regarding the readiness of advanced fuel cycle plants. While alternatives to the once-through fuel cycle and the modified open fuel cycle have not been deployed on a widespread and commercial scale, the U.S. nuclear industry has tremendous capability to support fuel cycle needs.

If the Subcommittee believes that characteristics of current U.S. fast reactor products are insufficient to meet U.S. used fuel management needs, it would be beneficial to understand what the Subcommittee believes those characteristics are and what would be required to meet the U.S.'s advanced fuel cycle needs. A policy that is driven by the U.S. industrial spirit in response to clearly articulated policy goals would indeed "benefit to preserving and developing new options." (Subcommittee Draft Report, page v). A clearly articulated policy direction and federal leadership

would focus U.S. RD&D and ensure measurable progress and market confidence for private investment. GEH supports the Subcommittee call for "broader energy policy objectives, rather than . . . an a priori commitment to a particular system or fuel cycle option" (Subcommittee Draft Report, page x).

Understanding the reason for this lack of support for a more near-term commercial scale deployment is paramount to establishing an improved strategy for advanced fuel cycle technology and should not be assumed to be either technological or economical. With the exception of cost, the evaluation criteria identified in the BRC's charter (i.e., safety, resource utilization and sustainability, used fuel management, and non-proliferation and counter-terrorism) are not primarily driven by market forces. GEH is a leading supporter of addressing these issues in its products and services, but capturing benefits in these areas more broadly will require more than RD&D; it will require policy incentives to supplement market forces and progress advanced fuel cycle technologies to commercial application. This is true regardless of the extent of public research and development that is undertaken.

Accordingly, GEH encourages the Subcommittee to make used fuel policy recommendations in the form of objectives for advanced reactor and fuel cycle technologies and specific incentives to encourage industry activity to develop and deploy technologies that meet those objectives. For example, the recommendations could include encouraging progress with technologies that have the greatest effect on safety, resource utilization and sustainability, the promotion of nuclear nonproliferation and counter-terrorism goals, and used fuel storage and disposal needs could be considered. Such incentives should be made available throughout the course of research, development, demonstration, and commercial-scale deployment. Incentives available for commercial-scale deployment are the most critical because they encourage accomplishing the end objective of making major strides in improving our nuclear fleet capabilities and safety. This level of measured policy direction need not commit the U.S. irreversibly to specific technologies nor to a wholesale change in nuclear infrastructure.

Furthermore, rather than forecasting the Subcommittee's RD&D supposed timeline, with which GEH respectfully disagrees, it may be more beneficial to articulate the desired fuel cycle technology capability. We advocate that the Subcommittee reconsider its judgment regarding the amorphous timeline for U.S. commercial products and services for fuel cycle technology. This, in conjunction with policy incentives, would help drive industry to develop or further develop technologies to help achieve the policy objectives in as little time as may be necessary. This would be more consistent with a policy that encourages U.S. nuclear leadership driven by the U.S. industrial spirit.

In sum, without a clearer understanding of what U.S. RD&D must achieve to be deemed ready for widespread application, U.S. industry will be wary of investing in reactor and fuel cycle RD&D.

3. A Solid Regulatory Framework Is Essential to Productive RD&D and Full-Scale Deployment

The Subcommittee Draft Report recommends that "[a] portion of the federal nuclear energy RD&D resources should be directed to the U.S. Nuclear Regulatory Commission (NRC) to accelerate a regulatory framework and supporting anticipatory research for novel components of advanced nuclear energy systems. An increased degree of confidence that new systems can be successfully licensed is important for lowering barriers to commercial investment." (Subcommittee Draft Report, page vii).

GEH agrees with the importance of strengthening NRC's ability to support advanced fuel cycle technology licensing. Based upon GEH's experience with DOE's NP2010 program, we believe the most effective improvement in this area would be accomplished by undertaking actual licensing and design review activities. Consistent with this approach, the Subcommittee Draft Report notes that "[t]he NRC Commissioners have directed the NRC staff to pilot the technology neutral framework from NUREG-1860 in parallel with the licensing strategy for the NGNP. Support for the NRC's efforts to pilot the NUREG-1860 framework on the NGNP program has been provided under a reimbursable work contract with the DOE." (Subcommittee Draft Report, page 64). A technology neutral framework is best tested by ensuring that it can support at least two different types of technologies. NGNP is one of two basic types of advanced reactor/fuel cycle technologies that the Subcommittee Draft Report notes has promise. (Subcommittee Draft Report, page 61). The other referenced type of advanced reactor is fast-spectrum reactors with a closed fuel cycle. Accordingly, GEH recommends that a program be established to use a portion of the proposed additional nuclear energy RD&D licensing resources to exercise NUREG-1860 for a fast-spectrum reactor designed for use in a closed fuel cycle, such as the GEH PRISM reactor.

Another challenge to advanced RD&D and the productivity of public/private partnerships is noted by the Subcommittee: the federal cost sharing of development costs. The Subcommittee Draft Report notes "that at the stage of commercial-scale demonstration, federal cost sharing of development costs with industry can assure that the technology has actual commercial potential—as evidenced by private-sector willingness to invest—while still addressing the issues associated with first-mover risk that can otherwise prevent sufficient investment in new technologies." (Subcommittee Draft Report, page 58). As a private company, GEH underscores that the willingness of the private-sector to invest is a function of the value that can be created by the features of the product that differentiate it from its competition. Most of the differentiating value from advanced fuel cycle technology, especially until such time as first-of-a-kind risk is resolved, is associated with federal government responsibilities such as energy security, used fuel disposal, resource conservation, and proliferation. Until such time as policy makes value available in exchange for these benefits, it would be inaccurate to conclude that insufficient commercial potential is the reason such reactors are not in service.

The Subcommittee Draft Report opines that "current industry willingness to invest substantial financial resources into the development of small, modular reactors based on light water reactor technology provides evidence for the commercial potential of this technology." (Subcommittee Draft Report, page 58). On the contrary, GEH believes that a comparison to some willingness on the part of industry to invest in the development of small, modular reactors based on light water reactor technology is faulty. This is because the purported differentiating value of small modular light water reactors ("LWRs") results almost entirely from lower capital costs yielding a lower cost of producing electricity (i.e. a commercial commodity), which is yet to be a proven result.

The Subcommittee Draft Report further states that "[t]he return on investment also depends upon the structure under which electricity prices and waste disposal fees are assessed. For example, under the existing Nuclear Waste Policy Act fee structure, the services of spent fuel transportation, consolidated interim storage, and disposal are provided as a bundled service for a fee assessed based upon total electricity generation. Absent a mechanism to rebate cost savings, the bundling of these services removes economic incentives to implement technologies that could reduce transportation, storage, and disposal costs." (Subcommittee Draft Report, page 28). This is an important observation and GEH requests that the Subcommittee address this issue with a corresponding recommendation.

4. International Partnerships Benefit U.S. Advances

The Subcommittee Draft Report states that "[t]he United States should continue to take a leadership role in international efforts to address global non-proliferation concerns and to improve the safety and security of nuclear facilities and materials worldwide. This could include: support for multi-national, industrial-scale fuel cycle facilities, joint efforts with other countries to improve security and accountability technologies and protocols for nuclear materials and capabilities, and improvements in existing multilateral agreement frameworks." (Subcommittee Draft Report, page viii).

GEH agrees with the Subcommittee's call for U.S. leadership in international efforts. We also believe that such multi-national cooperation can and should be structured in such a way to also support the U.S. domestic nuclear industry and U.S. exports. This would require more direct involvement of U.S. suppliers and industry in multi-national activities. U.S. industry can offer its experience with execution and technology application to supplement multi-national policy and research collaboration and better enable cooperation to yield technological progress. It is critical that as international collaborations are established that there is involvement of the U.S. private sector from the start so that commercial consideration can be balanced with critical non-proliferation interests.

5. Additional Technical Comments

A. Fast-Spectrum Reactors and TRU

In the Subcommittee Draft Report, Table 5 on page 35 states that for energy security, a fast-spectrum reactor with a closed fuel cycle is about the same as baseline (i.e. once-through LWRs). GEH disagrees with this assessment and considers that employing a fast-spectrum reactor in a closed fuel cycle has a potentially significant benefit in reducing petroleum imports used in the transportation sector due to increased interest in electric powered vehicles and other increases in the use of electricity. This is especially true considering the large amount of additional energy available from uranium by using a fast-spectrum reactor in a closed fuel cycle, which essentially makes large new supplies of fuel for generating electricity available domestically.

Additionally, the Subcommittee Draft Report opines that "closed fuel cycles with fast reactors operate with large inventories of TRU in the reactor cores and in out-of-reactor fuel cycle facilities. The actual rates of consumption of TRU tend to be small compared to the total TRU inventories, so that decades to centuries can be required to significantly decrease the total TRU inventory. This implies a long-term commitment to the operation of fast reactors, or the willingness to place the fast reactor fuel into disposal if a more rapid transition to a different energy source is desired in the future." (Subcommittee Draft Report, page 47). For report completeness, it should also be noted that the reason why the consumption rate of TRU is small compared to what we are accustomed to with LWRs is because there is a large amount of potential energy available in the TRU and fast reactors can make this energy available.

Furthermore, it is not clear that fast reactors represent a long-term commitment simply due to the fact that TRU fuel is consumed slowly in one or several fast reactors. This would not obligate the U.S. in any way to build additional fast reactors if a scenario arose in which the energy from TRU was no longer wanted and other technology were developed that could eliminate the TRU more rapidly and/or with some other benefit. The only commitment would be to the individual fast reactors constructed, but the energy produced is such a large portion of the plant's economic case that any reduction in revenue from TRU consumption as a result of the introduction of competing technologies is unlikely to have a significant impact on the economic performance of the plant, especially in the later years of plant operation unless the value of electricity fell dramatically. Single-plant demonstration of the two fuel cycle/reactor technologies that this report identifies as having the most promise would not commit the U.S. irreversibly to any particular fuel cycle. In fact, it would likely revitalize all parts of the nuclear industry including national laboratories, academic institutions, utilities, regulation, suppliers, engineering, and manufacturing and provide viable options for the future.

B. Advanced Aqueous processing and Pyro-chemical processing

As the Subcommittee notes, two forms of advanced separations processes for LWR and fast reactor fuels are being pursued: (1) Advanced Aqueous processing; and (2)

Pyro-chemical Processing (or "Pyroprocessing"). (Subcommittee Draft Report, page 62). The Pyroprocessing process is applicable to metallic fast reactor fuels. It is based on molten salt electro-refining, a technique that has been used since 1996 for conditioning metallic spent fuel from the EBR-II reactor. The Subcommittee states that "[b]oth technologies face major challenges in meeting the stated goals. Scale-up to commercial throughputs, economics, and waste stream management are all particularly challenging." (Id.)

The U.S. nuclear industry has tremendous capability to support fuel cycle needs. GEH presented recycling technology to the BRC that would commercialize the U.S. RD&D efforts accomplished during the ALMR program. DOE funding contributed to the development of this technology; under the right policy conditions, the technology could be deployed in the near-term. It is not clear, therefore, how the Subcommittee and BRC could reach a conclusion regarding the readiness of Pyroprocessing unless a negotiation process on deployment is undertaken. It is a fact that Pyroprocessing has not been deployed on a widespread and commercial scale. But if the Subcommittee considers that characteristics of this process and resulting product are insufficient to meet U.S. used fuel management needs, it would be beneficial to understand those characteristics and what would be necessary to meet the U.S.'s advanced fuel cycle needs.

C. Impact on Nuclear Power Deployment

The Subcommittee Draft Report states that "[a]s with reactors, once fuel cycle facilities are built they can be expected to operate for many decades. Thus decisions by industry to construct commercial-scale infrastructure will have major and very long term impacts on nuclear power development." (Subcommittee Draft Report, page 71)

GEH does not agree with the implication that all commercial fuel cycle facilities need be of such a large scale that they establish, "major and very long term impacts." The technology that GEH presented to the BRC has an approximate steady-state used fuel processing rate of 50 MT/year because it need not be designed and constructed as a centralized facility similar to MOX processing currently performed in some other countries. Rather, it is designed to work in conjunction with several small, modular, fast reactors on a single site (for example, as part of an energy park). By comparison, the U.S. has approximately 60,000 MT of used nuclear fuel. A demonstration recycling plant with a processing rate of 50 MT/year would have an insignificant effect on future used fuel policy flexibility, yet potentially offering an option that would provide greater flexibility in developing future used fuel policies.